CDM Smith

Memorandum

To: *Claire Maulhardt, Capital Region Water*

From: *Terry Meeneghan, Jeff Eveland*

Date: *September 16, 2021*

Subject: *Regulator Modification Overview*

During the September 14, 2021 remote meeting between CRW and the regulatory agencies, the planned activities for modifying the CSO regulator structures were discussed. This memo was prepared, at the request of the agencies, to provide a written overview of those activities. The modifications are summarized briefly below and described in the following subsections.

- There are seven categories of regulator modifications, five for CSO control and two for structural rehabilitation. Given the configuration of the CRW regulator structures, the CSO control and structural modifications can and will be implemented independently.
- The H/H model was used to identify the combination of CSO control modifications for each regulator structure. The field inspections were used to identify the flap gates and CSO outfall pipes requiring structural rehabilitation or replacement.
- The CSO control modifications will be implemented within 3 phases as indicated within the PCD Appendix B table and Table 1 within this memo. The structural modifications will be implemented under an independent schedule.
- The details for the CSO control modifications will need to be flexible under the adaptive management principal and allow the selected elements, dimensions, and implementation phasing of the modifications for individual structures to evolve as the H/H model is updated to reflect completed projects and monitoring data.

Implementation Phasing

The CSO control regulator modifications have not been implemented as early action projects under the Nine Minimum Controls because the structural condition of the Front Street and Paxton Creek interceptors would not allow it. There would be a significant risk that high pressure heads could damage the structurally compromised interceptor pipes. Given that the Front Street interceptor (FSI) and Paxton Creek interceptor (PCI) both discharge to the Front Street Pump Station (FSPS), once the combined flow from the interceptors exceeds the FSPS pumping capacity, flow in both interceptors will start to backup and the water surface will rise. The downstream end of the FSI is

flatter/lower in elevation (compared to PCI), so it will begin to surcharge first. If the combined interceptor flow continues to increase, the PCI would begin to surcharge.

The existing CSO regulator structure configurations prevent the interceptors from surcharging during storm events. A limited number of regulators can be modified after the completion of the Front Street Pump Station project (Phase 1) because the increased hydraulic capacity can convey the additional wet weather flow without surcharging the interceptors. Additional regulators can be modified after the completion of the Front Street interceptor rehabilitation project (Phase 2) when the pipes can safely withstand surcharge loads. The remaining regulators can be modified after the completion of the Paxton Creek interceptor rehabilitation/replacement project (Phase 3).

Categories of Regulator Structure Modifications

There are seven categories or components of regulator structure modification and repair activities described in the 2018 CBH_2OPP. The first five activity categories maximize flow to the interceptors and increase systemwide CSO capture. The last two categories are for structural rehabilitation or replacement. The following definitions and descriptions of these activities are critical in understanding the wide range and complexity of the work that needs to be done.

- ***Chain Open B&B Gates*** – This is the **first component** of the regulator modifications. Chaining open the Brown and Brown (B&B) variable control orifice gates is the most cost-efficient way to maximize flow to the interceptors. Under existing conditions, once the water level in a regulator chamber reaches a certain level, the gate will close to restrict or stop flow to the interceptor. Eventually, the B&B components may be demolished and removed.

- ***Raise Weir*** – This is the **second component** of the regulator modifications. Given the various diversion weir configurations within the CRW system, this may be a relatively simple modification in some cases, or it may involve reconfiguring and/or relocating the weir. For example, if the weir is located immediately in front of the outfall pipe leaving the diversion chamber, and the recommended weir increase equals or exceeds the diameter of the outfall pipe, the weir may need to be moved back further from the outfall pipe to avoid obstructing the outfall opening.

- ***Remove Restriction*** – This is the **third component** of the regulator modifications. In addition to chaining open B&B gates, it may be necessary to enlarge the dimensions of the control orifice, between the diversion chamber and regulator chamber, if the flow area is more limiting than the dimensions and flow area of the connector pipe to the interceptor. Completely removing the B&B mechanism at the diversion/regulator chamber control orifice may sufficiently increase the orifice size, or the physical opening of the orifice may need to be enlarged further.

- ***Expand Connector Pipe*** – This is the **fourth component** of the regulator modifications, where the diameter of the connector pipe is enlarged (currently proposed at three locations) for its entire length, from the regulator chamber to the interceptor.

- ***Interceptor Backflow Prevention*** – This is the **fifth component** of the regulator modifications and consists of installing a flap gate, or some other backflow-prevention mechanism, in the regulator chamber. When the interceptor rehabilitation and regulator modification work are completed, the interceptors will surcharge during storms to maximize wet weather flow to the pump stations and AWTF. The interceptor backflow gates would prevent the surcharged interceptor from backflowing up the influent trunk sewers.

- ***CSO Outfall Pipe Repairs*** – This is a **sixth activity category** which can be completed independently of the regulator modifications. The 2018 CBH_2OPP includes critical, medium, and low priority outfall repairs as part of the Baseline, and all three priorities of pipe rehabilitation are currently required under PCD Appendix B (Items 9a and 9b).

- ***CSO Outfall Flap Gate Repairs/Replacement*** – This is a **seventh activity category** which can be completed independently of the regulator modifications. Like the outfall pipes, the 2018 CBH_2OPP identified critical, medium and low priority flap gate repairs as part of the Baseline, and all three priorities of rehabilitation are currently required under PCD Appendix B (Items 9a and 9b).

- ***Additional Regulator Modifications*** – This additional category of regulator modifications is NOT considered part of the PCD Appendix B activities. Recent H/H model analyses have shown that following the implementation of green stormwater infrastructure (GSI) and/or in-line storage, in some cases, selected CSO diversion weir elevations may be raised further to promote additional increases to wet weather capture. Peak flow reductions resulting from the GSI and in-line storage facilities could allow a weir elevation to be raised further without causing upstream street flooding or basement backups.

Implementation Phasing

The CSO control regulator modifications have not been implemented as early action projects under the Nine Minimum Controls because the structural condition of the Front Street and Paxton Creek interceptors would not allow it. There would be a significant risk that high pressure heads could damage the structurally compromised interceptor pipes. The existing CSO regulator structure configurations prevent the interceptors from surcharging during storm events. A limited number of regulators (Phase 1) can be modified after the completion of the Front Street Pump Station project because the increased hydraulic capacity can convey the additional wet weather flow without surcharging the interceptors. Additional regulators can be modified after the completion of the Front Street interceptor rehabilitation project (Phase 2) when the pipes can safely withstand surcharge loads. The remaining regulators can be modified after the completion of the Paxton Creek interceptor rehabilitation/replacement project (Phase 3).

Prior H/H modeling analyses have shown that the proposed regulator modifications can be completed in three phases. These phases are included in the PCD Appendix B project list.

- **Phase 1** (Appendix B Item 7c, *currently scheduled for the first 6 months of 2022)*
  – regulator modifications following Front Street Pumping Station (FSPS) upgrade

- **Phase 1A** – initially, regulator modifications shall be limited to chaining open selected B&B gates; and raising weirs for Hemlock Street Interceptor CSO regulators and select CSO regulators prone to creek backflow
- **Phase 1B** – remainder of Phase 1 regulator modifications

- **Phase 2 -** Appendix B Item 9a, *currently scheduled for completion by June 30, 2023* – regulator modifications following Front Street interceptor rehabilitation
- **Phase 3 -** Appendix B Item 9b, *currently scheduled for completion by September 30, 2030* – regulator modifications following Paxton Creek interceptor rehabilitation

Currently Proposed Modifications for each Regulator Structure

Table 1 is color coded to identify which implementation phase and which regulator modification components correspond to each regulator structure. CSO outfall pipe rehabilitation and CSO outfall flap gate repair/replacement activities were deliberately excluded from the table because they can be completed independently of the regulator modifications.

Table 1. Phased Regulator Modifications.

Catchment	Planning Area	Chain Open B&B Gates	Raise Weir / Required Increase	Remove Restriction	Expand Connector Pipe	Interceptor Backflow Prevention
S-004	Riverside	✓	✓ (+1 ft)	✓		✓
S-005	Riverside	✓	✓ (+1 ft)	✓		✓
S-049	Uptown	✓	✓ (+3 ft)			✓
S-050	Uptown	✓	✓ (+3 ft)			✓
S-051	Uptown	✓	✓ (+1 ft)			✓
S-006	Uptown	✓	✓ (+3 ft)			✓
S-007	Uptown	✓	✓ (+1 ft)			✓
S-008	Uptown	✓	✓ (+2 ft)			✓
S-009	Uptown	✓				✓
S-010	Uptown	✓	✓ (+2 ft)			✓
S-011	Uptown	✓	✓ (+1.25 ft)			✓

Table 1. Phased Regulator Modifications.

Catchment	Planning Area	Chain Open B&B Gates	Raise Weir / Required Increase	Remove Restriction	Expand Connector Pipe	Interceptor Backflow Prevention
S-012	Middle Front Street	✓	✓ (+1 ft)	✓		✓
S-013	Middle Front Street	✓	✓ (+1 ft)			✓
S-014	Middle Front Street	✓	✓ (+2.75 ft)	✓		✓
S-015	Middle Front Street	✓	✓ (+1 ft)	✓		✓
S-016	Middle Front Street	✓	✓ (+1 ft)	✓		✓
S-052	Middle Front Street	✓	✓ (+1.75 ft)			✓
S-053	Middle Front Street	✓	✓ (+1 ft)			✓
S-054	Middle Front Street	✓	✓ (+1 ft)	✓		✓
S-055	Middle Front Street	✓	✓ (+1 ft)			✓
S-056	Middle Front Street	✓	✓ (+1 ft)	✓		✓
S-017	Lower Front Street	✓	✓ (+1 ft)			✓
S-018	Lower Front Street	✓	✓ (+3 ft)			✓
S-019	Lower Front Street	✓	✓ (+1 ft)	✓		✓
S-020	Lower Front Street	✓	✓ (+1 ft)			✓
S-057	Lower Front Street	✓				✓
S-058	Lower Front Street	✓				✓
S-021	Upper Paxton Creek - West	✓	✓ (+3 ft)*	✓		✓
S-022	Upper Paxton Creek - West	✓	✓ (+3 ft)*			✓
S-024	Upper Paxton Creek - West	✓	✓ (+2.5 ft)*	✓		✓
S-027	Upper Paxton Creek - West					
S-028	Upper Paxton Creek - West	✓	✓ (+1 ft)			✓
S-023	Upper Paxton Creek - East	✓	✓ (+1 ft)	✓		✓

Table 1. Phased Regulator Modifications.

Catchment	Planning Area	Chain Open B&B Gates	Raise Weir / Required Increase	Remove Restriction	Expand Connector Pipe	Interceptor Backflow Prevention
S-025	Upper Paxton Creek - East	✓	✓ (+2 ft)			✓
S-026	Upper Paxton Creek - East	✓	✓ (+1.25 ft)	✓		✓
S-030	Middle Paxton Creek - West	✓	✓ (+1 ft)			✓
S-032	Middle Paxton Creek - West					
S-037	Middle Paxton Creek - West	✓	✓ (+1 ft)	✓	✓	✓
S-038	Middle Paxton Creek - West	✓	✓ (+3 ft)			✓
S-041	Middle Paxton Creek - West					
S-029	Middle Paxton Creek - East	✓	✓ (+1 ft)	✓		✓
S-031	Middle Paxton Creek - East	✓	✓ (+1 ft)	✓	✓	✓
S-033	Middle Paxton Creek - East	✓	✓ (+1.25 ft)	✓		✓
S-034	Middle Paxton Creek - East	✓	✓ (+1.5 ft)	✓		✓
S-039	Middle Paxton Creek - East	✓	✓ (+1.75 ft)	✓		✓
S-040	Middle Paxton Creek - East	✓	✓ (+1.75 ft)	✓		✓
S-042	Lower Paxton Creek	✓	✓ (+1 ft)	✓		✓
S-043	Lower Paxton Creek	✓	✓ (+1 ft)	✓		✓
S-044	Lower Paxton Creek	✓	✓ (+1 ft)			
S-045	Lower Paxton Creek	✓	✓ (+3 ft)			✓
S-046	Lower Paxton Creek	✓	✓ (+3 ft)			✓
S-048	Lower Paxton Creek	✓	✓ (+3 ft)	✓		✓
S-059	Lower Paxton Creek		✓ (+3 ft)	✓		
S-060	Hemlock Street					
S-061	Hemlock Street	✓	✓ (+1 ft)	✓		✓

Table 1. Phased Regulator Modifications.

Catchment	Planning Area	Chain Open B&B Gates	Raise Weir / Required Increase	Remove Restriction	Expand Connector Pipe	Interceptor Backflow Prevention
S-062	Hemlock Street	✓	✓ (+1 ft)	✓		✓
S-063	Hemlock Street	✓	✓ (+1 ft)	✓	✓	✓
S-064	Hemlock Street	✓	✓ (+1 ft)	✓		✓

Color Coding:

1. Phase 1A regulator modifications.
2. Phase 1B regulator modifications.
3. Phase 2 regulator modifications.
4. Phase 3 regulator modifications.
5. Regulator modifications for sewer separation candidates will not be implemented.
6. **Bold, red font indicates weir raises not included in the original CBH_2OPP.**

*Final weir raises for CSOs 021, 022, and 024 to be evaluated further.

Adaptive Management

These modifications are based upon the H/H model with design phase Front Street pump curves, set points, and operation logic and may change as final field verified pump station values are input into the model. The specific details for any of the CSO control modifications will need to be flexible under the adaptive management principal and allow the selected elements, dimensions, and implementation phasing of the modifications for each individual structure to evolve as the H/H model is updated to reflect completed projects and monitoring data.